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(71) Applicant and

(72) Inventor: TSUBAI, Kenzo [US/US]; 3637 W. Alabama #155, Houston, TX 77027 (US).

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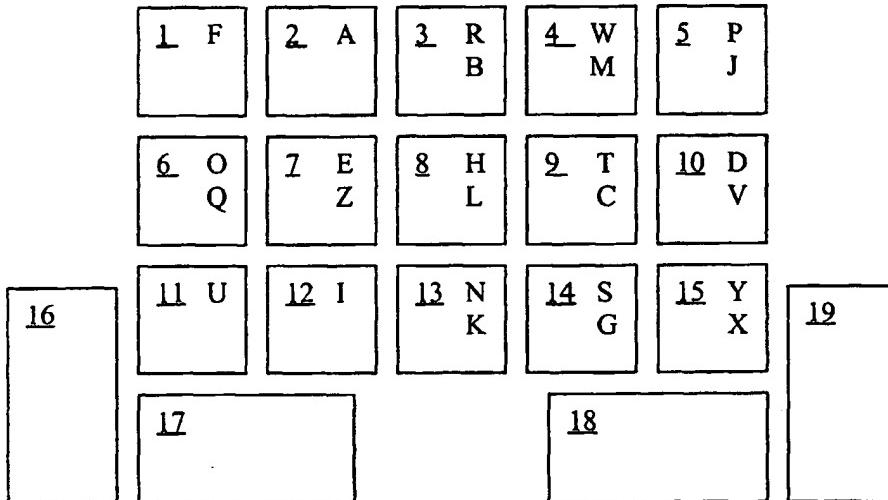
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(54) Title: DATA ENTRY KEYBOARD



## DATA ENTRY KEYBOARD

### BACKGROUND OF THE INVENTION

5

**Field of Invention.** This invention relates to a one-handed data entry keyboard for use with a computer or like devices. Specifically, the invention describes a keyboard layout ergonomically designed to minimize finger movement based on the most common letters and combinations of letters used in the English language.

- 10   **Related Art.** As computers and like devices get smaller and more portable, it is desirable to have smaller than standard-sized keyboards. While the size of the electronics can be reduced to microscopic levels, and the display can be miniaturized and compensated by various methods including scrolling, the keyboard input remains a physical size limitation for the new generation of portable computers. Currently, this need is typically met by the
- 15   "miniaturized keyboard", in which the size of standard layout keys is reduced to achieve the smaller sizes desired. This miniaturization is typically of a standard QWERTY keyboard, so named for the first six keys on the top row. This approach has limited efficiency and a minimum level of miniaturization, since the size of users' hands and fingers remains constant. Thus, multiple keys are inadvertently stuck, or the user resorts to
- 20   typing each key with the forefingers in a "hunt and peck" style.

A preferred approach to the problem is one-hand keyboards. These keyboards are smaller, since they require fewer keys than the minimum 72-key computer keyboard. By requiring fewer keys, one-hand keyboards can use full-sized keys.

- 25   Besides the benefit to miniaturized portable computers, one-hand keyboards are also useful in any application where one-hand use is preferred. Examples of such uses include CAD/CAM operators, who prefer to keep one hand on a "mouse" input device while the second hand remains on the keyboard; inventory recording devices which allow the user to handle items with one hand while inputting data with the other; and users with disabilities that allow the functional use of only one hand.
- 30   One type of one-hand keyboard is a "chording" keyboard. Just as simultaneous striking of keys on a keyboard for a musical instrument, such as a piano, result in a distinct musical chord, simultaneous striking of keys on a chording computer alphanumeric input keyboard

result in various letters. These keyboards have a small number of keys, typically five. Thus striking the first two keys may result in the letter "A", and striking the first, third and fifth key may result in the letter "Z". These systems have coding systems that are difficult to learn and master. Besides having to learn chording codes for upper and lower case letters as well as numerals, the user must also remember less frequently used commands such as "Control", "Alternate", "Escape", etc.

The preferred one-hand keyboard is of the type described by Tsubai in U. S. Patent 5,793,312, herein incorporated by reference. This keyboard has a plurality of primary alphanumeric keys, at least one secondary key, and a controller. When a primary alphanumeric key is depressed alone, its output signal results in the output of a primary letter, numeral or function. When a primary alphanumeric key is depressed simultaneously with one or more secondary keys, the controller interprets the multiple output signals and outputs a secondary letter, numeral or function. This keyboard operates very well, and is easy to learn the codes that are printed on top of each key as in a standard keyboard. However, a standard for the keyboard layout, based on ergonomic and heuristic principals, needs to be developed for use of such one-hand keyboards.

The speed, pace and rhythm of typing relies in part on "alternating keystrokes". It is faster to hit a first key and a second key with different fingers ("alternating keystrokes"), rather than hitting the same key or different keys with the same finger ("redundant keystrokes").

It would be a new and useful improvement of the prior art for a keyboard layout to be developed that is easy to learn and minimizes finger movement and redundant keystrokes.

#### BRIEF SUMMARY OF THE INVENTION

Accordingly, the objectives of this invention are to provide, inter alia, a new and improved one-hand keyboard layout that:

- is easy to learn;
- requires minimum finger movement;
- minimizes redundant keystrokes;
- allows fast data input; and
- includes all alphanumeric and functional keys found on a standard computer keyboard.

These objectives are addressed by the structure and use of the inventive one-hand

keyboard layout. A nineteen key keypad, comprising fifteen primary and four secondary keys, is laid out in a manner that maximizes the number of character signals generated from located on a "home" position or by using single keystrokes. The fifteen primary alphanumeric keys are laid out in three rows with five keys in each row. The most 5 commonly used letters in the English language are on keys in a primary mode (not requiring the simultaneous striking of one or more secondary function keys). Further, the most common two-letter combinations (digraphs) are on keys in the primary mode and proximate to one another. Other objects of the invention will become apparent from time to time throughout the specification hereinafter disclosed.

10 BRIEF DESCRIPTION OF THE DRAWINGS

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Figure 1 depicts the preferred inventive layout of a one-handed right-handed keyboard.

20 Figure 2 depicts the preferred inventive layout of a one-handed right-handed keyboard without identifying numerals.

Figure 3 depicts the preferred inventive layout of a one-handed right-handed keyboard without identifying numerals, plus the preferred layout of numeric keys.

Figure 4 depicts the preferred finger placement for right-handed users.

25 Figure 5 depicts the placement of the top 10 Dvorak primary alphanumeric keys on a one-handed right-handed keypad.

Figure 6 depicts the preferred inventive layout of a one-handed left-handed keyboard without identifying numerals.

Figure 7 depicts the preferred inventive layout of a one-handed left-handed keyboard without identifying numerals, plus an alternate layout of numeric keys.

30 Figure 8 depicts the preferred finger placement for left-handed users.

Figure 9 depicts the letter placement of the 30 most common digraphs.

Figure 10 depicts the letter placement of five common digraphs requiring the use of the same finger for keying.

## DETAILED DESCRIPTION OF THE INVENTION

The present invention is described as keyboard layout 50, depicted in block diagram form in Figures 1 - 8. The inventive keyboard is designed for use with any device requiring an alpha-numeric input, such as a desktop computer, Personal Digital Assistant 5 (PDA), laptop computer, computer aided drafting/manufacturing (CAD/CAM) device, inventory recorder, equipment controller or other device in which a one-handed keypad would benefit the user.

Key 16, key 17, key 18 and key 19 are shown in Figures 1-8 to depict the preferred embodiment of the secondary keys. This invention, however, is primarily directed to the 10 layout of primary alphanumeric key 1 through primary alphanumeric key 15. Primary alphanumeric keys 1 – 15 are arranged in a top row of five, a middle row of five and a bottom row of five. Each of the five keys in each row are aligned with keys in the other two rows, to form five columns, as depicted in Figures 1 – 10. While the preferred embodiment of the arrangement of the five columns of primary keys are vertical and 15 aligned, it is understood that these columns make alternatively be arranged slightly offset, diagonal, staggered, or any other roughly vertical alignment preferred by the user/designer. Likewise, the three rows are depicted in Figure 1 – 10 as straight horizontal rows. Alternatively, these rows may be slightly offset, diagonal, staggered, or any other roughly horizontal arrangement preferred by the user/designer.

20 The secondary keys 16 – 19 are arranged below and/or offset to the sides of primary alphanumeric keys 1 – 15, as depicted in Figures 1 – 8. The primary alphanumeric keys (keys 1 – 15 shown in Figure 1) are capable of generating an electric signal for alphanumeric (A – Z and 0 – 9) symbols. The primary alphanumeric keys generate a signal for a primary letter solely by pressing the primary alphanumeric key. Signals for 25 secondary letters and numerals are generated by depressing a primary alphanumeric key and at least one secondary key. The secondary keys (keys 16 – 19 of Figure 1) are also capable of generating computer function signals, as well as generating secondary signals that allow the user to select a secondary letter or numeral for a key. Secondary keys 16 – 19 also control upper and lower case designation of letters.

30 All keyboard layouts 50 are directed to a one-handed keyboard, depicted in the preferred embodiment and herein incorporated by reference as that described in the Tsubai U. S. Patent No. 5,793,312. Alternate embodiments include any device having a keypad/keyboard with a reduced number of keys.

The preferred alphabetical keyboard layout 50 is depicted in Figure 1. Keys 1 – 15 are the primary alphanumeric keys, and keys 16 – 19 are secondary keys used for functions such as "Shift", "Alternate", "Control", "Numeral Lock", etc. All 26 letters of the English alphabet are represented on Keys 1 through 15. With the exception of Keys 1, 2, 11, and 12, each key contains two letters, a primary letter (shown at the top of each key) and a secondary letter (shown in the middle or lower portion of each key). Users may choose between the primary and secondary letters by utilizing any of a number of ways available. For example, pressing a single primary alphanumeric key (Keys 1 – 15) generates a signal for the primary letter depicted on the upper portion of the key. To generate a signal representing the secondary letter depicted in the lower portion of the key, the user presses at least one of the secondary keys (Keys 16 – 19) before pressing the primary alphanumeric key. Alternatively, the user may press a primary alphanumeric key and a secondary key concurrently, as described in the Tsubai U. S. Patent No. 5,793,312, to generate a signal for a secondary letter. Functions other than alphabetic, such as symbols, may be entered by first pressing, and thereby changing the key functions from alphabetic to symbolic or function, by first pressing one or more of the secondary keys.

The primary letters of the primary alphanumeric keys are F, A, R, W, P, O, E, H, T, D, U, I, N, S and Y. These letters account for 85.087% of alphabetic occurrences in words in the English language. The user is therefore able to type the vast majority of all words without striking any secondary keys, affording high typing speeds.

Figure 2 shows, for the purposes of clarity, the keys without their identifiers (identifier numerals 1 – 19). Figure 3 shows the keys again without their identifiers (numerals 1 – 19), plus the location of device keys for the numerals 0 – 9, arranged in a standard numeric keypad orientation. In the preferred embodiment, signals for numerals 0 – 9 are generated by changing the primary alphanumeric key function with a secondary key, typically key 17, 18 and/or 19.

As seen in Figure 4, the preferred right-handed "home" orientation of the operator's fingers on the keypad is the Thumb on Key 16, Index Finger on Key 7, Middle Finger on Key 8, Ring Finger on Key 9, and Pinky Finger on Key 15. The arrows emanating from each finger indicator show the preferred finger movement to keys away from the "home" position. These arrows depict the most natural and efficient way of striking all 15 primary alphanumeric keys according to hand ergonomic principals, including minimization of finger travel distance, crossover and reach.

The frequency of single letters in the English language, in descending order, is shown in Table 1:

Letter	Percentage of total occurrences	Letter	Percentage of total occurrences
E	12.702	M	2.406
T	9.056	W	2.360
A	8.167	F	2.228
O	7.507	G	2.015
I	6.996	Y	1.974
N	6.749	P	1.929
S	6.327	B	1.492
H	6.094	V	0.978
R	5.987	K	0.772
D	4.253	J	0.153
L	4.025	X	0.150
C	2.782	Q	0.095
U	2.758	Z	0.074

5

TABLE 1

Source: H. Beker and F. Piper, *Cipher Systems*, Wiley-Interscience, 1982.

- As is shown in Table 1, the most frequently used letters in the English language are
- 10 E, T, A, O, I, N, S, H, R and D. Using nine of these letters, and substituting in the letter U for R, Professor August Dvorak developed the Dvorak keyboard in the early 20<sup>th</sup> Century. The letters A, O, E, U, I, D, H, T, N and S comprise the middle row of keys in the Dvorak keyboard, as these letters account for 70% of all occurrences of letters used in the English language.
- 15 The same letters found on the middle row of a Dvorak Simplified Keyboard (DSK) are shown in Figure 5. While the letter R may be slightly more frequent in use than the letter U, keyboard layout 50 allows the keys for all five vowels to be struck by the index finger, and the five most common consonants are struck by the middle and ring fingers.

- Having the vowels all on primary alphanumeric keys struck with the same index finger is heuristically advantageous, since at least one vowel is found in every common English word. In addition, it is ergonomically advantageous to alternate keystrokes between fingers, avoiding having the same finger striking the same or different keys sequentially.
- 5 Since most English words use consonants between vowels, this ensures a greater percentage of keystrokes alternating between fingers. Further, since the index, middle and ring fingers are the most nimble and strongest fingers, their frequent use keying vowels is ergonomically expedient.

If the user is left-handed, Figure 6 depicts the preferred keyboard layout. The  
10 layout in Figure 6 is a reverse mirror image of that found in Figures 1 and 2, and affords the user the same fingering advantages as described above for the right-handed keyboard. In Figure 7, this same left-handed layout is shown, with an alternate numeric keypad orientation. The numeric keypad is engaged as described above for Figure 3. The numerals are reversed as shown, allowing the user the option of a numeric keypad in which  
15 the numerals ascend "outward" (from index finger to ring finger), plus having the numerals "1", "4" and "7" punched by the "home" index finger. This alternate numeric keypad can also be incorporated into the alphabetical keypad depicted in Figures 1 and 2, if the user should so desire.

Figure 8 the preferred left-handed "home" orientation of the operator's fingers on  
20 the keypad is the Thumb on Key 19, Index Finger on Key 9, Middle Finger on Key 8, Ring Finger on Key 7, and Pinky Finger on Key 11. The arrows emanating from each finger indicator show the preferred finger movement to keys away from the "home" position. These arrows depict the most natural and efficient way of striking all 15 primary alphanumeric keys according to hand ergonomic principals.

25 In addition to having the most frequently used letters ergonomically arranged as primary letters (not requiring depression of a secondary key) on the primary alphanumeric keys, the keyboard layout described in Figures 1 – 4 (and analogously in Figures 6 – 8) also affords an efficient layout of digraphs. A digraph is a sequence of two letters that make a single sound when spoken. According to August Dvorak et al., *Typewriting Behavior*, 1936, New York, American Book Company, the 137 most common digraphs make up 90% of English text. The 11 most common digraphs account for one-quarter of the letters used in English words, 34 make up one-half, and just 57 digraphs account for three-quarters of all typewritten copy.

The thirty most common digraphs, in order, are:

Digraph	Ranking of occurrences	Digraph	Ranking of occurrences
th	1	nt	16
er	2	ea	17
on	3	ti	18
an	4	to	19
re	5	it	20
he	6	st	21
in	7	io	22
ed	8	le	23
nd	9	is	24
ha	10	ou	25
at	11	ar	26
en	12	as	27
es	13	de	28
of	14	rt	29
or	15	ve	30

TABLE 2

- 5       Figure 9 shows the placement on the present inventive keyboard of the 30 most common digraphs used in the English language shown in Table 2, which account for over a third of the keystrokes in the written word. Of these 30 digraphs, 28 use primary letters only. The only two of these most common digraphs that use a secondary letter are the digraph "le", which uses primary letter "e" and secondary letter "l", and the digraph "ve", which uses primary letter "e" and secondary letter "v". The frequency ranking of these two digraphs is relatively low, with "le" ranked 23<sup>rd</sup> and "ve" ranked 30<sup>th</sup>. In addition, the layout minimizes the number of digraphs that require striking keys that are not on adjacent rows. The exceptions to these placements are "an" and "as". Finally, as seen in Figure 10, only five of the top 30 digraphs require the same finger to strike consecutive keys. Of 10 these five none require finger travel from the top row to the bottom row, further improving 15 typing efficiency. None of the 30 most common digraphs require the use of the same key

to strike the primary letter and the secondary letter.

In the preferred embodiment, the keys are standard sized using standard placement. The tops of the keys are  $\frac{1}{2}$ " square, and placement of the keys are  $\frac{3}{4}$ " center to center between keys. The primary alphanumeric keys are aligned in three rows and five columns,  
5 also aligned as depicted in Figures 1 – 8.

The foregoing disclosure and description of the invention are illustrative and explanatory thereof. Various changes in the details of the illustrated construction may be made within the scope of the appended claims without departing from the spirit of the invention. The present invention should only be limited by the following claims and their  
10 legal equivalents.

1

CLAIMS

2 I claim:

3 1. A keyboard for a data entry system operable with one hand, comprising:

4 a top row, a middle row and a bottom row of primary alphanumeric keys, each of  
5 said rows having five keys;6 said top row, middle row and bottom row of primary alphanumeric keys further  
7 forming a first column, a second column, a third column, a fourth column, and a fifth  
8 column of said primary alphanumeric keys, said first column being the furthest to the left,  
9 said second, third, fourth and fifth columns respectively listed subsequently being further to  
10 the right;11 each of said plurality of primary alphanumeric keys capable of generating a primary  
12 signal for a primary letter and a secondary signal for a secondary letter;13 each said primary signal being generated by solely depressing one of said primary  
14 alphanumeric keys;15 each said secondary signal being generated by depressing one of said primary  
16 alphanumeric keys and at least one secondary key;17 said primary alphanumeric key in said top row and said first column capable of  
18 generating a primary signal for a primary letter "F";19 said primary alphanumeric key in said top row and said second column capable of  
20 generating a primary signal for a primary letter "A";21 said primary alphanumeric key in said top row and said third column capable of  
22 generating a primary signal for a primary letter "R" and a secondary signal for a secondary  
23 letter "B";24 said primary alphanumeric key in said top row and said fourth column capable of  
25 generating a primary signal for a primary letter "W" and a secondary signal for a secondary  
26 letter "M";27 said primary alphanumeric key in said top row and said fifth column capable of  
28 generating a primary signal for a primary letter "P" and a secondary signal for a secondary  
29 letter "J";30 said primary alphanumeric key in said middle row and said first column capable of  
31 generating a primary signal for a primary letter "O" and a secondary signal for a secondary  
32 letter "Q";

1        said primary alphanumeric key in said middle row and said second column capable  
2        of generating a primary signal for a primary letter "E" and a secondary signal for a  
3        secondary letter "Z";

4        said primary alphanumeric key in said middle row and said third column capable of  
5        generating a primary signal for a primary letter "H" and a secondary signal for a secondary  
6        letter "L";

7        said primary alphanumeric key in said middle row and said fourth column capable  
8        of generating a primary signal for a primary letter "T" and a secondary signal for a  
9        secondary letter "C";

10        said primary alphanumeric key in said middle row and said fifth column capable of  
11        generating a primary signal for a primary letter "D" and a secondary signal for a secondary  
12        letter "V";

13        said primary alphanumeric key in said bottom row and said first column capable of  
14        generating a primary signal for a primary letter "U";

15        said primary alphanumeric key in said bottom row and said second column capable  
16        of generating a primary signal for a primary letter "I";

17        said primary alphanumeric key in said bottom row and said third column capable of  
18        generating a primary signal for a primary letter "N" and a secondary signal for a secondary  
19        letter "K";

20        said primary alphanumeric key in said bottom row and said fourth column capable  
21        of generating a primary signal for a primary letter "S" and a secondary signal for a secondary  
22        letter "G"; and

23        said primary alphanumeric key in said bottom row and said fifth column capable of  
24        generating a primary signal for a primary letter "Y" and a secondary signal for a secondary  
25        letter "X".

26

27        2.        The keyboard as in claim 1, said at least one secondary key selected from a group of  
28        four secondary keys.

29

30        3.        The keyboard as in claim 2, further comprising:

31        said group of four secondary keys comprising a first, second, third and fourth  
32        secondary key;

1        said first secondary key oriented offset to the left of said bottom row of primary  
2        alphanumeric keys;  
3        said second and third secondary keys oriented below said bottom row of primary  
4        alphanumeric keys; and  
5        said fourth secondary key oriented offset to the right of said bottom row of primary  
6        alphanumeric keys.

7

8        4.      The keyboard as in claim 1, further comprising:  
9            a means for generating a numeric signal;  
10          said means for generating said numeric signal comprising depressing at least one  
11        said secondary key and one of said primary alphanumeric keys;  
12          said primary alphanumeric key in said top row and said second column capable of  
13        generating said numeric signal for a numeral "7";  
14          said primary alphanumeric key in said top row and said third column capable of  
15        generating said numeric signal for a numeral "8";  
16          said primary alphanumeric key in said top row and said fourth column capable of  
17        generating said numeric signal for a numeral "9";  
18          said primary alphanumeric key in said middle row and said second column capable  
19        of generating said numeric signal for a numeral "4";  
20          said primary alphanumeric key in said middle row and said third column capable of  
21        generating said numeric signal for a numeral "5";  
22          said primary alphanumeric key in said middle row and said fourth column capable  
23        of generating said numeric signal for a numeral "6";  
24          said primary alphanumeric key in said bottom row and said second column capable  
25        of generating said numeric signal for a numeral "1";  
26          said primary alphanumeric key in said bottom row and said third column capable of  
27        generating said numeric signal for a numeral "2";  
28          said primary alphanumeric key in said bottom row and said fourth column capable  
29        of generating said numeric signal for a numeral "3"; and  
30          said primary alphanumeric key in said bottom row and said fifth column capable of  
31        generating said numeric signal for a numeral "0".

32

1    5.    The keyboard as in claim 1, further comprising:  
2            a means for generating a numeric signal;  
3            said means for generating said numeric signal comprising depressing at least one  
4            said secondary key and one of said primary alphanumeric keys;  
5            said primary alphanumeric key in said top row and said second column capable of  
6            generating said numeric signal for a numeral "9";  
7            said primary alphanumeric key in said top row and said third column capable of  
8            generating said numeric signal for a numeral "8";  
9            said primary alphanumeric key in said top row and said fourth column capable of  
10          generating said numeric signal for a numeral "7";  
11          said primary alphanumeric key in said middle row and said second column capable  
12          of generating said numeric signal for a numeral "6";  
13          said primary alphanumeric key in said middle row and said third column capable of  
14          generating said numeric signal for a numeral "5";  
15          said primary alphanumeric key in said middle row and said fourth column capable  
16          of generating said numeric signal for a numeral "4";  
17          said primary alphanumeric key in said bottom row and said second column capable  
18          of generating said numeric signal for a numeral "3";  
19          said primary alphanumeric key in said bottom row and said third column capable of  
20          generating said numeric signal for a numeral "2";  
21          said primary alphanumeric key in said bottom row and said fourth column capable  
22          of generating said numeric signal for a numeral "1"; and  
23          said primary alphanumeric key in said bottom row and said first column capable of  
24          generating said numeric signal for a numeral "0".

25  
26    6.    A keyboard for a data entry system operable with one hand, comprising:  
27            a top row, a middle row and a bottom row of primary alphanumeric keys, each of  
28            said rows having five keys;  
29            said top row, middle row and bottom row of primary alphanumeric keys further  
30            forming a first column, a second column, a third column, a fourth column, and a fifth  
31            column of said primary alphanumeric keys, said first column being the furthest to the left,  
32            said second, third, fourth and fifth columns respectively listed subsequently being further to

1 the right;

2 each of said plurality of primary alphanumeric keys capable of generating a primary

3 signal for a primary letter and a secondary signal for a secondary letter;

4 each said primary signal being generated by solely depressing one of said primary

5 alphanumeric keys;

6 each said secondary signal being generated by depressing one of said primary

7 alphanumeric keys and at least one secondary key;

8 said primary alphanumeric key in said top row and said first column capable of

9 generating a primary signal for a primary letter "P" and a secondary signal for a secondary

10 letter "J";

11 said primary alphanumeric key in said top row and said second column capable of

12 generating a primary signal for a primary letter "W" and a secondary signal for a secondary

13 letter "M";

14 said primary alphanumeric key in said top row and said third column capable of

15 generating a primary signal for a primary letter "R" and a secondary signal for a secondary

16 letter "B";

17 said primary alphanumeric key in said top row and said fourth column capable of

18 generating a primary signal for a primary letter "A";

19 said primary alphanumeric key in said top row and said fifth column capable of

20 generating a primary signal for a primary letter "F";

21 said primary alphanumeric key in said middle row and said first column capable of

22 generating a primary signal for a primary letter "D" and a secondary signal for a secondary

23 letter "V";

24 said primary alphanumeric key in said middle row and said second column capable of

25 generating a primary signal for a primary letter "T" and a secondary signal for a secondary

26 letter "C";

27 said primary alphanumeric key in said middle row and said third column capable of

28 generating a primary signal for a primary letter "H" and a secondary signal for a secondary

29 letter "L";

30 said primary alphanumeric key in said middle row and said fourth column capable of

31 generating a primary signal for a primary letter "E" and a secondary signal for a secondary

32 letter "Z";

1        said primary alphanumeric key in said middle row and said fifth column capable of  
2    generating a primary signal for a primary letter "O" and a secondary signal for a secondary  
3    letter "Q";

4        said primary alphanumeric key in said bottom row and said first column capable of  
5    generating a primary signal for a primary letter "Y" and a secondary signal for a secondary  
6    letter "X";

7        said primary alphanumeric key in said bottom row and said second column capable  
8    of generating a primary signal for a primary letter "S" and a secondary signal for a  
9    secondary letter "G";

10       said primary alphanumeric key in said bottom row and said third column capable of  
11    generating a primary signal for a primary letter "N" and a secondary signal for a secondary  
12    letter "K";

13       said primary alphanumeric key in said bottom row and said fourth column capable  
14    of generating a primary signal for a primary letter "I"; and

15       said primary alphanumeric key in said bottom row and said fifth column capable of  
16    generating a primary signal for a primary letter "U".

17

18    7.      The keyboard as in claim 6, said at least one secondary key selected from a group of  
19    four secondary keys.

20

21    8.      The keyboard as in claim 7, further comprising:

22       said group of four secondary keys comprising a first, second, third and fourth  
23    secondary key;

24       said first secondary key oriented offset to the left of said bottom row of primary  
25    alphanumeric keys;

26       said second and third secondary keys oriented below said bottom row of primary  
27    alphanumeric keys; and

28       said fourth secondary key oriented offset to the right of said bottom row of primary  
29    alphanumeric keys.

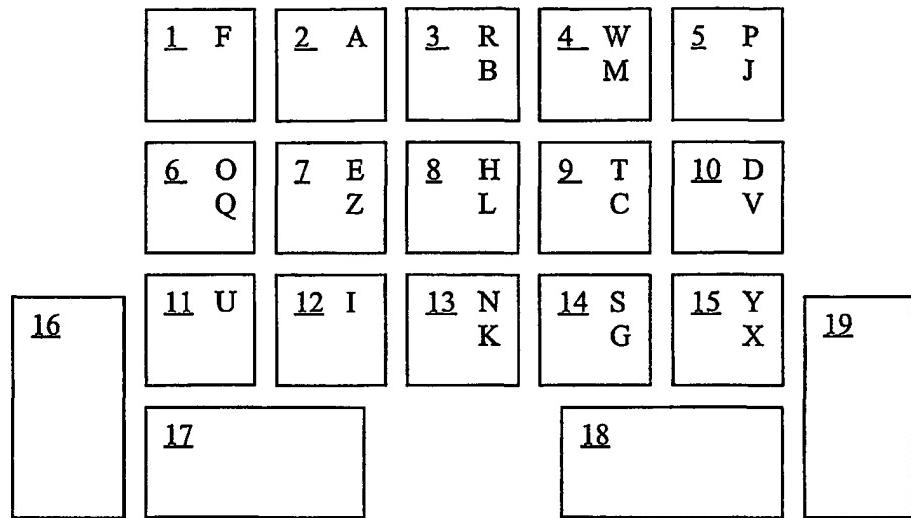
30

31    9.      The keyboard as in claim 6, further comprising:

32       a means for generating a numeric signal;

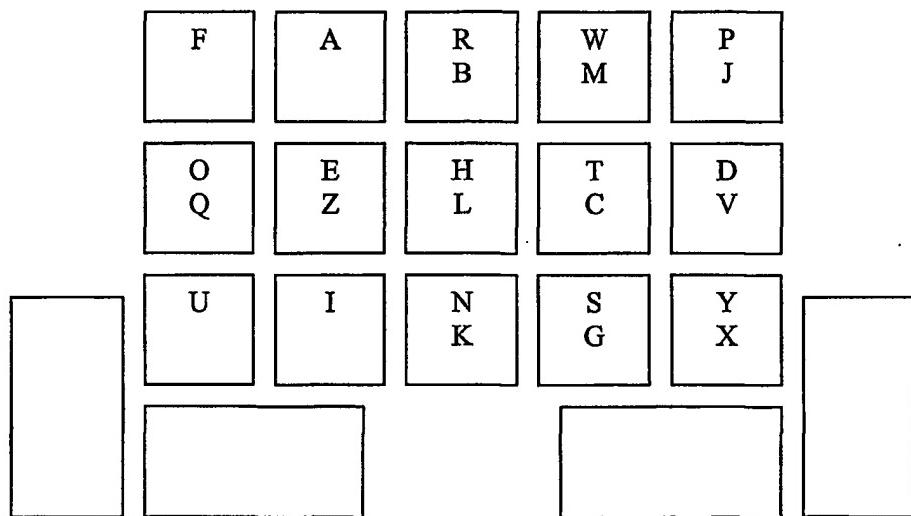
1        said means for generating said numeric signal comprising depressing at least one  
2        said secondary key and one of said primary alphanumeric keys;  
3                said primary alphanumeric key in said top row and said second column capable of  
4        generating said numeric signal for a numeral "7";  
5                said primary alphanumeric key in said top row and said third column capable of  
6        generating said numeric signal for a numeral "8";  
7                said primary alphanumeric key in said top row and said fourth column capable of  
8        generating said numeric signal for a numeral "9";  
9                said primary alphanumeric key in said middle row and said second column capable  
10      of generating said numeric signal for a numeral "4";  
11                said primary alphanumeric key in said middle row and said third column capable of  
12      generating said numeric signal for a numeral "5";  
13                said primary alphanumeric key in said middle row and said fourth column capable  
14      of generating said numeric signal for a numeral "6";  
15                said primary alphanumeric key in said bottom row and said second column capable  
16      of generating said numeric signal for a numeral "1";  
17                said primary alphanumeric key in said bottom row and said third column capable of  
18      generating said numeric signal for a numeral "2";  
19                said primary alphanumeric key in said bottom row and said fourth column capable  
20      of generating said numeric signal for a numeral "3"; and  
21                said primary alphanumeric key in said bottom row and said fifth column capable of  
22      generating said numeric signal for a numeral "0".  
23  
24      10. The keyboard as in claim 6, further comprising:  
25                a means for generating a numeric signal;  
26                said means for generating said numeric signal comprising depressing at least one  
27        said secondary key and one of said primary alphanumeric keys;  
28                said primary alphanumeric key in said top row and said second column capable of  
29        generating said numeric signal for a numeral "9";  
30                said primary alphanumeric key in said top row and said third column capable of  
31        generating said numeric signal for a numeral "8";  
32                said primary alphanumeric key in said top row and said fourth column capable of

1 generating said numeric signal for a numeral "7";  
2       said primary alphanumeric key in said middle row and said second column capable  
3 of generating said numeric signal for a numeral "6";  
4       said primary alphanumeric key in said middle row and said third column capable of  
5 generating said numeric signal for a numeral "5";  
6       said primary alphanumeric key in said middle row and said fourth column capable  
7 of generating said numeric signal for a numeral "4";  
8       said primary alphanumeric key in said bottom row and said second column capable  
9 of generating said numeric signal for a numeral "3";  
10      said primary alphanumeric key in said bottom row and said third column capable of  
11 generating said numeric signal for a numeral "2";  
12      said primary alphanumeric key in said bottom row and said fourth column capable  
13 of generating said numeric signal for a numeral "1"; and  
14      said primary alphanumeric key in said bottom row and said first column capable of  
15 generating said numeric signal for a numeral "0".  
16



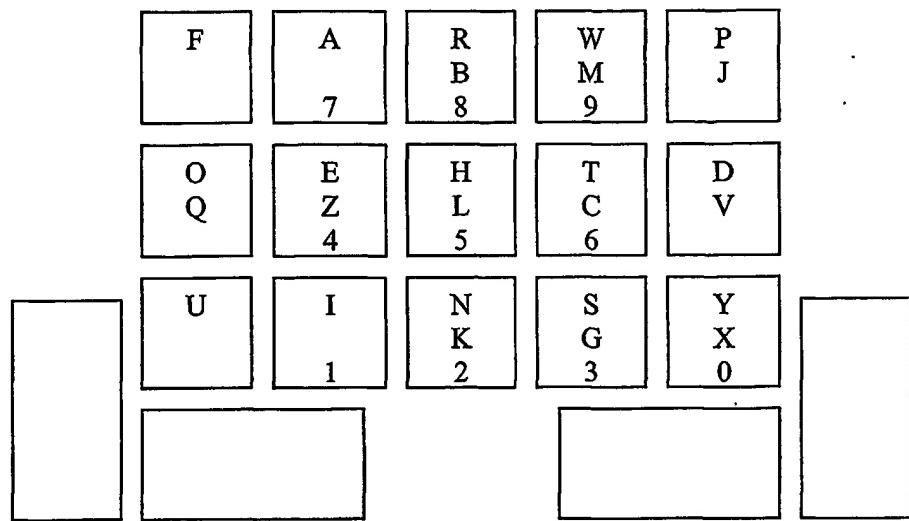
**FIGURE 1**

50



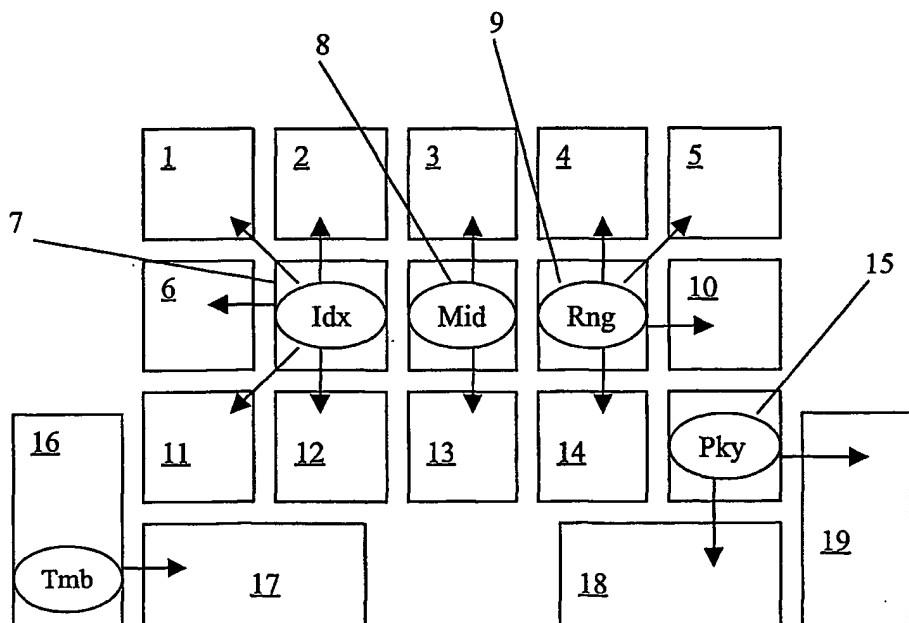
**FIGURE 2**

50



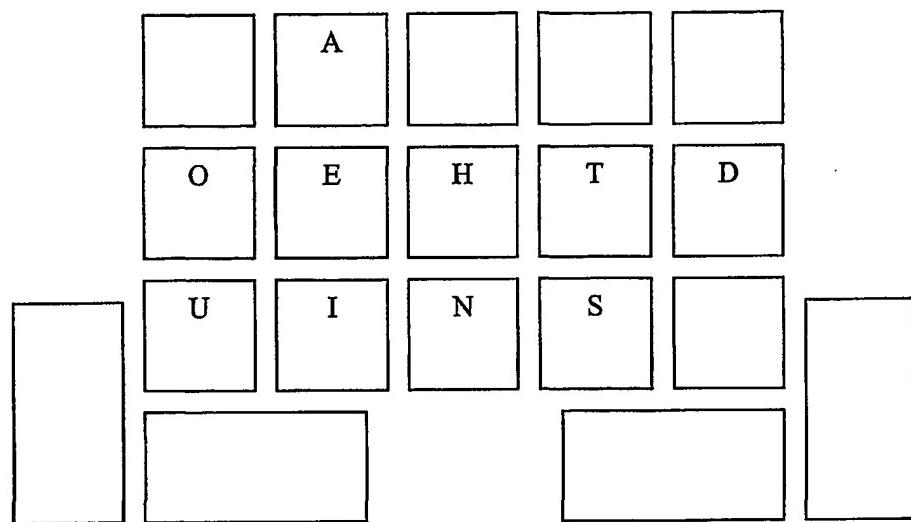
**FIGURE 3**

50



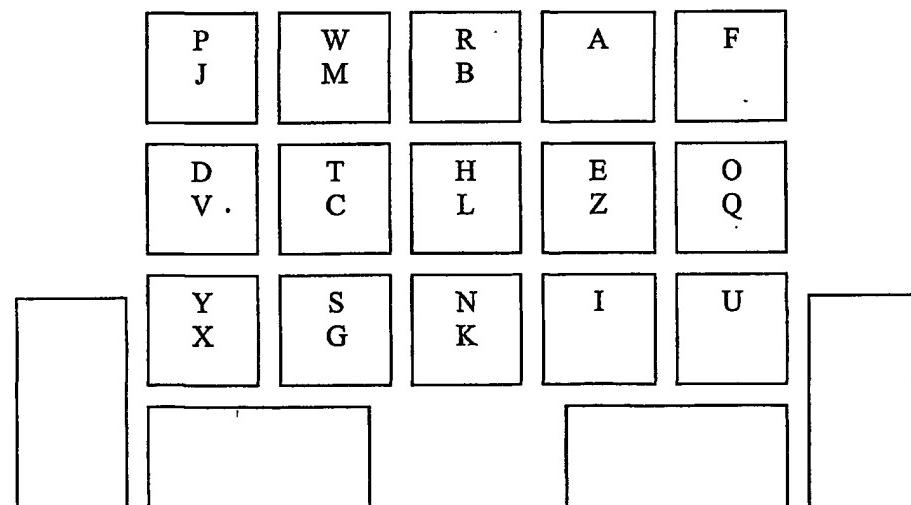
**FIGURE 4**

50



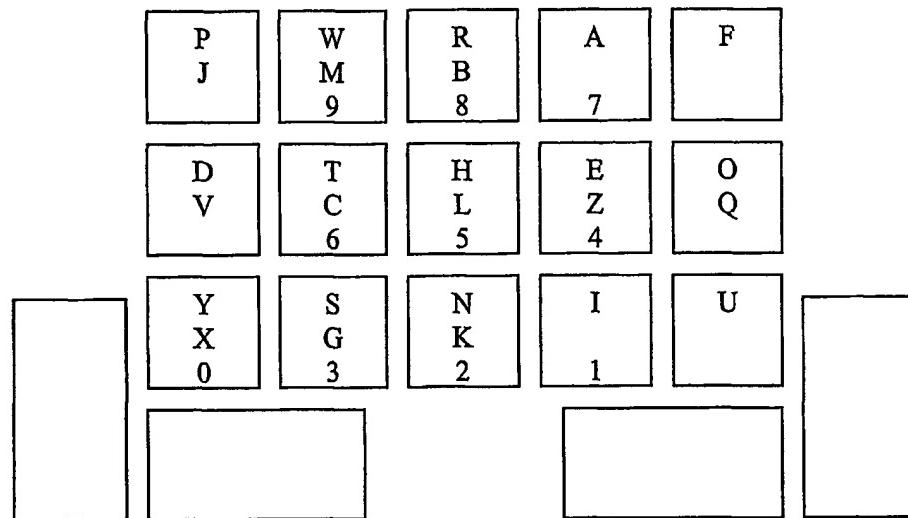
**FIGURE 5**

50

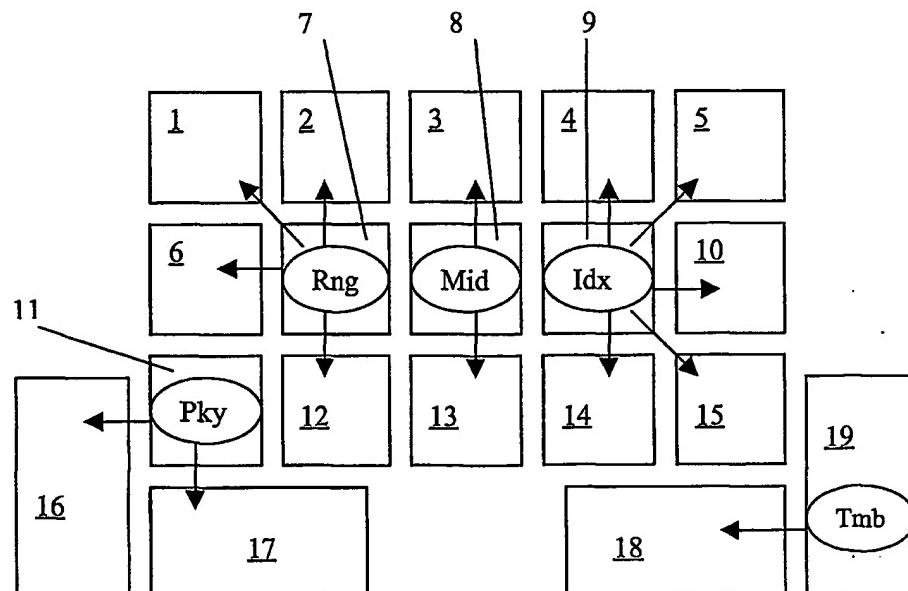


**FIGURE 6**

50

**FIGURE 7**

50

**FIGURE 8**

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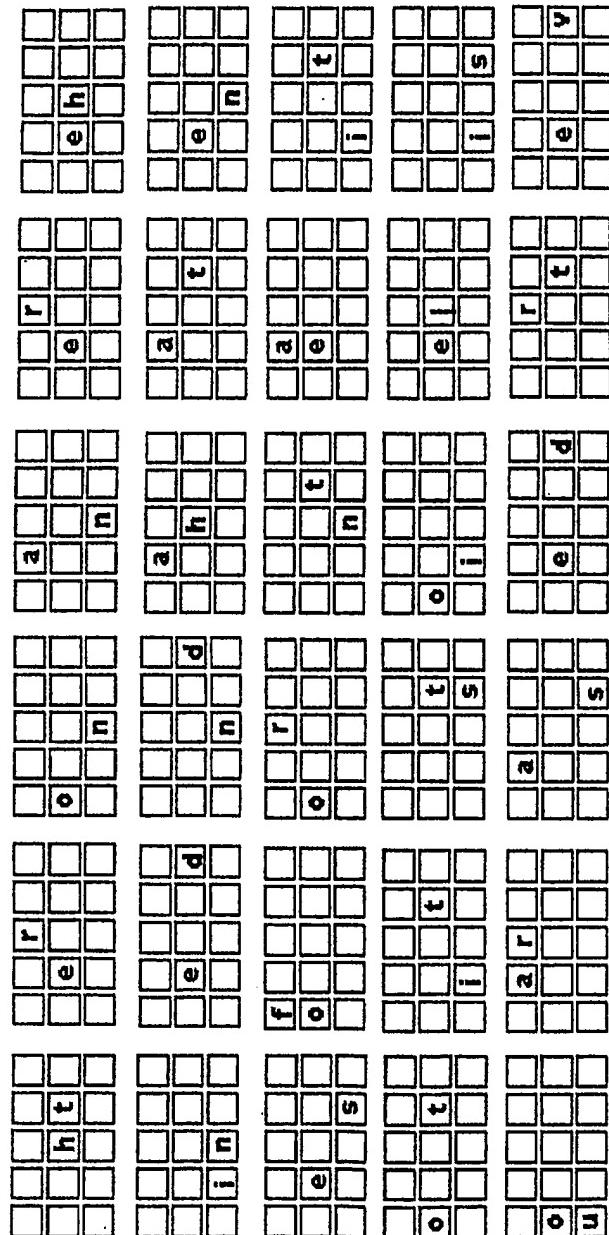
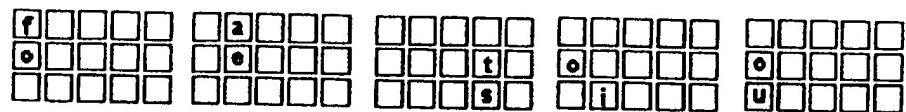


FIGURE 9

6/6



**FIGURE 10**

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US01/26197

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(7) :Please See Extra Sheet.

US CL : 341/20, 22, 23; 400/486, 489; 708/145, 146

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 341/20, 22, 23; 400/486, 489; 708/145, 146

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

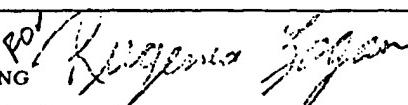
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US RE 34,304 A (GOLDWASSER et al) 06 JULY 1993, ALL	1-10
A	US 5,847,697 A (SUGIMOTO) 08 DECEMBER 1998, ALL	1-10
A	US 5,625,354 A (LERMAN) 29 APRIL 1997, ALL	1-10
A	US 5,258,748 A (JONES) 02 NOVEMBER 1993, ALL	1-10
A	US 5,367,298 A (AXTHELM) 22 NOVEMBER 1994, ALL	1-10
A	US 5,497,151 A (DOMBROSKI) 05 MARCH 1996, ALL	1-10

Further documents are listed in the continuation of Box C.  See patent family annex.

* Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance		
"E" earlier document published on or after the international filing date	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means		
"P" document published prior to the international filing date but later than the priority date claimed	"A"	document member of the same patent family

Date of the actual completion of the international search 25 SEPTEMBER 2001	Date of mailing of the international search report <b>19 NOV 2001</b>
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-5230	Authorized officer ALBERT WONG Telephone No. (703) 305-8864 

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US01/25197

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5,124,702 A (VAN ARDENNE) 23 JUNE 1992, ALL	1-10
A	US 5,003,301 A (ROMBERG) 26 MARCH 1991, ALL	1-10

**INTERNATIONAL SEARCH REPORT**

International application No.

PCT/US01/25137

**A. CLASSIFICATION OF SUBJECT MATTER:**

IPC (7):

H05K 17/94; H03M 11/00; G06F 05/00; B41J 05/08, 05/10, 05/12, 05/14, 05/16, 05/26, 05/28